(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 August 2004 (05.08.2004)

PCT

(10) International Publication Number
WO 2004/064573 A1

(51) International Patent Classification[7]: A46B 9/04

(21) International Application Number:
PCT/EP2004/000665

(22) International Filing Date: 19 January 2004 (19.01.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

0301248.1	20 January 2003 (20.01.2003)	GB
0317494.3	25 July 2003 (25.07.2003)	GB

(71) Applicant *(for all designated States except US)*: GLAXOSMITHKLINE CONSUMER HEALTHCARE GMBH & CO KG [DE/DE]; Bussmatten 1, D-77815 Buehl (Baden) (DE).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: GEORGI, Matthias [DE/DE]; GlaxoSmithKline Consumer Healthcare GmbH & Co KG, Bussmatten 1, D-77815 Buehl (Baden) (DE).

(74) Agent: WALKER, Ralph, Francis; GlaxoSmithKline, CN925.1, 980 Great West Road, Brentford, Middlesex TW8 9GS (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: TOOTHBRUSH

(57) Abstract: A toothbrush head having an undulating surface with at least one more displaced part and at least one less displaced part and with bristles having a triangular cross section extending from a more displaced part of the bristle face.

WO 2004/064573 A1

Toothbrush

This invention relates to toothbrushes, in particular to toothbrush heads having an undulating bristle face and bristles of a triangular cross section.

Generally a toothbrush has a head and a handle disposed along a longitudinal axis, the head having bristles arranged in tufts extending from a face thereof ("the bristle face") in a general bristle direction. It is known, e.g. in British Standards Institution publication BS 5757:1979 "Specification for Toothbrushes" that the stiffness of a toothbrush bristle is related to its length and diameter. For bristles of the same diameter and material, longer bristles will be less stiff than shorter bristles.

Generally the bristle face is planar. Toothbrushes are disclosed in inter alia WO 96/25866, GB 1098933, JP-UM-51-129261 and JP-UM-1-155825 in which the bristle face is longitudinally undulating.

Toothbrush bristles are normally mounted on the toothbrush head packed together in tufts. Generally toothbrush bristles are filaments of a polymeric material such as the well known Tynex™ bristles made of nylon, and have a circular cross section. Toothbrush bristles of other cross sections are also known e.g. having a triangular cross section, e.g. see US-A-4,493,125. Triangular cross section bristles have the advantage that they can penetrate the interproximal spaces between the teeth better than circular section tufts, and also they can be packed together more densely than circular sectioned bristles in a tuft as triangular shapes fit together without the interstitial voids that form between packed circular shapes. However triangular sectioned bristles are generally made of a smaller cross sectional area than circular sectioned bristles so are generally less stiff than circular sectioned bristles of the same length. This can be detrimental to their effectiveness in penetrating the interproximal spaces.

It is an object of the present invention is to provide a construction of toothbrush head which enables the effectiveness of triangular bristles in penetrating the interproximal spaces to be exploited, whilst improving the stiffness of such bristles relative to circular sectioned bristles.

According to this invention, a toothbrush head, connected to or connectable to a toothbrush handle, and which is elongated along a head longitudinal direction and

has a bristle face from which bristles extend in a bristle direction, the bristle face having an undulating surface that varies, with longitudinal distance along the head, in its displacement distance in a direction perpendicular to a plane passing through the head parallel to its longitudinal direction, so that there is at least one more displaced part and at least one less displaced part, is provided and is

characterised in that bristles having a triangular cross section extend from a more displaced part of the bristle face.

The bristle face may be displaced in the direction perpendicular to the plane, i.e. in the bristle direction, to form a more displaced part in various ways.

For example the bristle face may comprise one, or more than one, more displaced part comprising one or more widthways aligned ridge descending longitudinally to a less displaced part on each longitudinal side of the ridge. Such a ridge may be rounded in profile, e.g. a part-circular or part-oval curve as sectioned longitudinally. Alternatively such a ridge may have a triangular or wedge-shaped profile as sectioned longitudinally. For example the bristle face may have a domed, conical or pyramidal surface with the surface descending away longitudinally to a less displaced part on each longitudinal side of the more displaced part.

A particular profile of a more displaced part is a ridge which in plan looking down on the bristle face perpendicular to the longitudinal direction is a curved, e.g. crescentic or part circular curved, shape with its cusps on opposite sides of the longitudinal axis of the head, for example with its convex bulge facing away from the handle.

Another particular profile of a more displaced part is a ridge which in plan looking down on the bristle face perpendicular to the longitudinal direction is a "V" or chevron shape with its apex pointing away from the handle.

Such a curved or "V" plan ridge may in section be rounded or triangular shaped.

A less displaced part may for example comprise a flat part of the head longitudinally adjacent to a more displaced part. Preferably a less displaced part may be provided longitudinally between two more displaced parts, e.g. as a valley longitudinally between two ridges.

For example the bristle face may have a longitudinally undulating, e.g. sinusoidal, zigzag or other wave-form profile of two or more alternating more displaced parts, with a valley, i.e. less displaced part, arranged longitudinally between each longitudinally adjacent pair of more displaced parts. The descent from the more displaced part, or the ascent up from the less displaced part may be by a planar or curved slope, or stepwise.

Alternative constructions will be apparent to those skilled in the art.

Preferably the variation in displacement of the bristle face with the longitudinal distance forms a longitudinally undulating shape. Only the bristle face need be undulating, although the entire head of the toothbrush including the opposite face may be displaced perpendicular to the plane in a manner corresponding to the bristle face.

Preferably there are at least two more displaced parts, with a less displaced part longitudinally in between. The head has a base end closest to the toothbrush handle and an opposite tip end, and preferably there is a less displaced part adjacent to one or both of the base end and tip end.

A preferred arrangement of more and less displaced parts comprises: a first less displaced part adjacent the end of the head furthest from the handle (the "tip end"), a first more displaced part longitudinally adjacent to this first less displaced part and closer to the handle, a second less displaced part longitudinally adjacent the first more displaced part and closer to the handle, a second more displaced part longitudinally adjacent to this second less displaced part and closer to the handle so that the second less displaced part is longitudinally between the first and second more displaced parts, and a third less displaced part longitudinally adjacent the second more displaced part and closest to the handle.

Preferably the longitudinal spacing of the most displaced parts of such at least two more displaced parts corresponds approximately to the spacing between the interproximal spaces of adjacent teeth, and this is conveniently achieved using the arrangements of more and less displaced parts discussed above. Such a spacing can help to direct the triangular sectioned bristles into the interproximal spaces.

Typically the variation in displacement distance between more and less displaced parts may be 1-3 mm, e.g. 1.5mm +/- 20%.

The triangular sectioned bristles may have an equilateral or isosceles triangular section, or all of the sides may be different lengths. The term "triangular" includes triangular shapes with convex or concave curved sides and rounded apexes.

On the surface the bristles may be disposed in plural tufts each containing plural bristles. Such tufts may be disposed in generally longitudinally aligned rows of tufts, which need not be exactly parallel to the longitudinal direction.

The triangular sectioned bristles extend from one or more of the more displaced part(s) of the bristle face. Such bristles may extend from the most displaced part of a more displaced part, and may also extend from a part of the more displaced part between the most displaced part and the less displaced part, e.g. from the part of a more displaced part which descends toward a less displaced part. Triangular sectioned bristles may extend only from the more displaced parts. Triangular sectioned bristles may also extend from a less displaced part of the bristle face.

Preferably bristles having a round cross section extend from a less displaced part of the bristle face, e.g. from all of the less displaced parts.

The ends of the bristles remote from the bristle face may occupy an undulating e.g. longitudinally undulating profile.

An example of such an undulating profile is one in which the ends of the bristles occupy two height levels from the face, being a first greater height and a second lower height, with groups of tufts having their ends longitudinally alternatingly at the first or second height. For example tufts of the first height may extend from the more displaced parts, and tufts of the second height may extend from less displaced parts. For example a tuft or group of tufts furthest from the handle may have the first, greater height. Typically toothbrush bristles have a length 10-12 mm between the bristle face and the ends of the bristles, and the difference between the first and second height may be ca. 1.0 – 1.5mm.

Alternatively the length of the bristles may all be the same so that the ends of the bristles remote from the bristle face follow a profile corresponding to the bristle face.

Alternatively the length of the bristles may vary in direct inverse proportion to their displacement distance so that the ends of the bristles remote from the bristle face follow a planar profile.

Alternatively bristles extending from a more displaced part may be shorter than the bristles which extend from a less displaced part, to the extent that the ends of the bristles remote from the bristle face follow a profile having a concavity adjacent to a more displaced part.

Alternatively bristles extending from a more displaced part may be the same length as, shorter, or longer than the bristles which extend from a less displaced part, to the extent that the ends of the bristles remote from the bristle face follow a profile having a convexity adjacent to a more displaced part. However if the ends of the bristles remote from the bristle face follow a profile having a convexity adjacent to a more displaced part then preferably the length of the bristles extending from the more displaced part(s), e.g. the triangular section bristles, is less than the length of the bristles extending from the less displaced part(s).

Suitably the bristles extend from the bristle face in a bristle direction substantially perpendicular to the bristle face.

Alternatively bristles may be at a non-perpendicular angle to the bristle face. For example bristles may be arranged in longitudinally aligned rows of longitudinally sequential tufts, and the tufts in one such row may lean so that their ends remote from the face are closer to the tip end, and tufts in a widthways adjacent row may lean in the opposite way, so that as seen looking across the longitudinal direction the widthways adjacent rows appear to cross in an "X" shape. Leaning tufts arranged in this "crossed" way are known in the field e.g. from US-A-5,274,873, US-A-3,085,273 and US-A-2,242,743. Leaning tufts in this way helps to guide them into the interproximal spaces.

The bristles may be arranged in discrete tufts which may be circular cross section perpendicular to the bristle direction.

Alternatively the bristles may be arranged in one or more tuft of non circular section as cut perpendicular to the bristle direction, for example of elongated section, e.g. oval, rectangular optionally with rounded ends, or linear. For example such an elongated section tuft may be elongated along the longitudinal direction or across the width of the surface of the bristle face. For example such an elongated section tuft may have a section elongated along the longitudinal direction and may extend from a

more displaced part such that along the length of the elongated section of the tuft the displacement distance of the bristle face varies.

The stiffness of toothbrush bristles is influenced by their length, so that for bristles of the same cross section, longer bristles are less stiff, and conversely shorter bristles of smaller cross section can be made of comparable stiffness to longer bristles of a larger cross section. Therefore although bristles of triangular cross section are generally made with a cross section less than bristles of a round cross section, by locating the bristles of triangular section on a more displaced part they may be made shorter than bristles of a round cross section located at a less displaced part, but may be of similar stiffness.

Also in an elongated section tuft with a section elongated along the longitudinal direction and which extends from a more displaced part such that along the length of the elongated section of the tuft the displacement distance of the bristle face varies, the length of the bristles may also vary along the length of the more displaced part, so that the stiffness of the bristles may also vary along the length of the more displaced part. For example there may be longer, less stiff, bristles at a least displaced part of a more displaced part, and shorter, stiffer, bristles at a most displaced part of a more displaced part. For example there may be longer, less stiff, bristles at the longitudinal ends of a more displaced part, and shorter, stiffer, bristles at the longitudinal mid point of a more displaced part.

Tufts of bristles may be fastened into the toothbrush head in conventional ways, for example with conventional small metal clips. Preferably the tufts may be welded into the toothbrush head. A particularly preferred method for the fastening of tufts which are of non-circular cross section is that of moulding the plastics material of the head of the toothbrush around the ends of the tufts to be fastened into the head during the process of injection moulding manufacture of the head. Methods of welding in the tufts and/or tufts are for example disclosed in US-A-2643,158, DE-A-44 15 886A, EP-A-0326634A, EP-A-0346646A, US-A-5,823,633, US-A-2002/0056941 and EP-A-0197384A amongst other publications.

The invention also provides a toothbrush having a toothbrush head as described herein, and a grip handle, with a neck between the head and handle. The head may be integrally permanently connected to the handle or replaceably connected.

The toothbrush of the invention may include other known features of toothbrushes such as the "V" shaped folds of EP 0336641A or the flexible link between the head and the neck of WO 9724949, or the flexible tip of WO 9707707, or the combination of flexible tip and flexible link between the head and handle of WO 9837788.

The toothbrush may be made out of materials conventional in the art of toothbrushes, e.g. plastics materials, and may be made by conventional plastics moulding techniques.

The invention will now be described by way of example only with reference to the following drawings.

Fig. 1 Shows a cross section through a circular section tuft containing circular section bristles.

Fig. 2 Shows a cross section through a circular section tuft containing triangular section bristles.

Fig. 3 Shows a sideways view of a toothbrush head of this invention.

Fig. 4 Shows a plan view of the toothbrush head of Fig. 3.

Fig. 5 Shows a sideways view of another toothbrush head of this invention.

Fig. 6 Shows a plan view of the toothbrush head of Fig. 4.

Fig. 7 Shows the use of the toothbrush head of the invention in cleaning teeth.

Fig. 8 Shows a sideways view of another toothbrush head of this invention.

Fig. 9 Shows plan views of two more toothbrush heads of this invention.

Fig. 10 Shows a sideways view of another toothbrush head of this invention.

Fig. 11 Shows a sideways view of another toothbrush head of this invention.

Fig. 12 Shows an overall plan view of a toothbrush of this invention.

Referring to Fig. 1 bristles 10 of circular section are shown packed together to form a circular sectioned tuft 11 containing plural bristles 10. It is seen there are voids 12 between the bristles 10, making up a substantial proportion of the internal volume of the tuft 11.

Referring to Fig. 2 bristles 20 of triangular section are shown packed together to form a circular sectioned tuft 21 containing plural bristles 10. It is seen there are no, or only very small voids 22 between the bristles 20, so that there is little empty space in the internal volume of the tuft 21.

Referring to Figs. 3 and 4 a toothbrush head 31 is shown in side view, having a tip end 32 and a base end 33 at which it is integrally formed into a neck 34 by which it is integrally connected to a handle (not shown). The head 31 is elongated along a longitudinal direction A - - A and has a bristle face 35 from which bristles 36 extend in a bristle direction B perpendicular to the longitudinal direction A - - A.

The bristle face 35 has an undulating surface that varies with distance along the length A - - A of the head 31 in its displacement distance perpendicular to a plane passing through the head 31 parallel to its longitudinal direction A - - A. As seen in Figs. 3 and 4 this plane is also perpendicular to the bristle direction B. This is achieved by the bristle face 35 comprising two widthways aligned ridges 37, 38 each descending longitudinally to a less displaced part 39, 310, 311 on each longitudinal side of the ridge. The ridges 37, 38 are rounded in profile in a part-circular curve as sectioned longitudinally. The less displaced parts 39, 310, 311 comprise flat parts of the bristle face 35 adjacent to the more displaced parts 37, 38. The less displaced part 310 is longitudinally between the two more displaced parts 37, 38 as a valley longitudinally between these two ridges. The descent from the more displaced parts 37, 38, and hence the ascent up from the less displaced parts 39, 310, 311 is by curved slopes e.g. 37A, 38A.

The arrangement of more and less displaced parts shown in Fig. 3 therefore comprises a first less displaced part 39 adjacent the tip end 32 of the head 31, a first more displaced part 37 longitudinally adjacent to this first less displaced part 39 and closer to the handle, a second less displaced part 310 adjacent the first more displaced part 37 and closer to the handle, a second more displaced part 38 longitudinally adjacent to this second less displaced part 310 and closer to the handle so that the second less displaced part 310 is longitudinally between the first 37 and second 38 more displaced parts, and a third less displaced part 311 longitudinally adjacent the second more displaced part 38 and closer to the handle. The longitudinal spacing of the most displaced parts of the two more displaced parts 37, 38, i.e. the tops of the ridges 37, 38, corresponds approximately to the spacing between the interproximal spaces of adjacent teeth.

The height of the two more displaced parts 37, 38 relative to the less displaced parts 39, 310, 311 is ca. 1-3 mm.

The bristles 36 are disposed in circular sectioned tufts 41 containing plural bristles as seen more clearly in the plan view of Fig. 4. The tufts 410 extending from the more displaced parts 37, 38 are composed of bristles having a triangular cross section, i.e. as shown in Fig. 2. The tufts 411 extending from the less displaced parts 39, 310, 311 are composed of bristles having a circular cross section, i.e. as shown in Fig. 1. The tufts 411 are arranged in a polygonal cluster on the less displaced part 39, and in widthways aligned rows on the less displaced parts 310, 311.

The length of the bristles 36 vary in direct inverse proportion to their displacement distance from the plane, i.e. shorter bristles 410 are located on the more displaced parts 37, 38 and longer bristles 411 on the less displaced parts 39, 310, 311 so that the ends of the bristles 36 remote from the bristle face 35 follow a planar profile.

Referring to Figs. 5 and 6 a toothbrush head 51 is shown of similar construction to the head of Figs. 3 and 4. However in the head of Figs. 5 and 6 the bristles on the more displaced parts 37, 38 are arranged in tufts 510 of non circular section perpendicular to the bristle direction, being of an elongated rectangular section with rounded ends, elongated along the longitudinal direction A - - A. These elongated section tufts 510 are of such a length that along the length of the elongated section of the tuft 510 the displacement distance of the bristle face varies 35, being greater at the longitudinal mid-point of the tuft 510 than at the ends of the tuft 510. Consequently, the bristles at the longitudinal mid-point of the tuft 510 are stiffer than those at the ends of the tuft 510. The tufts 510 extending from the more displaced parts 37, 38 are composed of bristles having a triangular cross section, i.e. as shown in Fig. 2.

The tufts 511 extending from the less displaced parts 39, 310, 311 are composed of bristles having a circular cross section, i.e. as shown in Fig. 1. The tufts 511 are arranged in a polygonal cluster on the less displaced part 39, and in widthways aligned rows on the less displaced parts 310, 311.

The length of the shortest triangular sectioned bristles 20 in the tufts 410, 510 may be such that these bristles have a stiffness approximating to that of the longer circular sectioned bristles 10 in tufts 411.

Referring to Fig. 7 a toothbrush head 71 as shown in Fig. 3 is shown in use cleaning a set of teeth 72. It is seen that the spacing between the most displaced parts 37B, 38B of the more displaced parts 37, 38 correspond to the spacing between the interproximal gaps 73 between the teeth 72, so that the short triangular sectioned bristles 410 on the more displaced parts 37, 38 are well positioned to penetrate the spaces 73.

Referring to Fig. 8 a toothbrush head 81 is shown in a sideways view, having a construction generally corresponding to Figs. 3 and 4. However in the toothbrush of Fig. 8 the bristles 410 extending from the more displaced parts 37 are shorter than the bristles 411 which extend from less displaced parts 39, 310, 311, to the extent that the ends of the bristles remote from the bristle face follow a profile having a convexity adjacent to the more displaced parts 37, 38. In this profile the length of the triangular sectioned bristles 410 extending from the more displaced parts 37, 38 is less than the length of the bristles 411 extending from the less displaced parts 39, 310, 311. This is achieved by the difference h2 between the displacement distance of the ends of the bristles 410 and 411 from the plane A - - A being less than the difference h1 between the respective displacement distances of the less displaced parts 39, 310, 311 and more displaced parts 37, 38 from the plane A- -A.

In the toothbrush head of Fig. 8, although the bristles 410 of triangular cross section have a cross section less than the bristles 411 of a round cross section extending from the less displaced parts 39, 310, 311, the shorter length of the bristles 410 than the longer bristles 411 can give the bristles 410 and 411 a similar stiffness, or the bristles 410 may even be more stiff than the bristles 411.

Referring to Fig. 9 two plan views of toothbrush heads 91 and 92 are shown, looking down the bristle direction. The bristle face 93 of each head 91, 92 has two more displaced parts 94, 95. In the head 91 the more displaced parts 94 are in plan shape a curved crescentic shape with their cusps on opposite sides of the longitudinal axis of the head with their convex bulge facing away from the handle 96. In the head 92 the more displaced parts 95 are in plan shape a "V" or chevron shape with their apex pointing away from the handle 96. Tufts 97 in locations following the ridge line of the parts 94, 95 are composed of triangular sectioned bristles. In less displaced

parts 98 are tufts 99 of bristles of a circular section. The side view of the toothbrush heads 91, 92 is almost identical to Figs. 3 and 5.

Referring to Fig. 10 a side view of a toothbrush head 101 similar to that of Fig. 3 is shown, corresponding features being numbered correspondingly. However in Fig. 10 the ends of the bristles 36 remote from the bristle face occupy a longitudinally undulating profile. In Fig. 10 the undulating profile is one in which the ends of the bristles 36 occupy two height levels from the face. Tufts 412 and 410 have their ends at a first greater height from the bristle face, and tufts 411 have their ends at a second lower height from the bristle face. The longitudinal sequence of groups 412, 411, 410, 411, 410, 411 of tufts have their ends longitudinally alternatingly at the first or second height. Tufts 410 of the first height extend from the more displaced parts 37, 38, and tufts 411 of the second height extend from less displaced parts 39, 310, 311. Group of tufts 412 furthest from the handle have the first, greater height.

Referring to Fig. 11 a toothbrush head 110 (the handle is omitted for clarity) with an arrangement of tufts similar to that of Fig. 10 is shown in side view. The difference h1 between the respective displacement distances of the less displaced parts 39, 310, 311 and more displaced parts 37, 38 from the plane A- -A is ca. 1.6mm. The more displaced parts 37,38 are in plan crescent shaped as in Fig. 9. Also the tufts of bristles 36 are at a non-perpendicular angle to the bristle face and to the plane. The tufts 36 are arranged in longitudinally aligned rows of longitudinally sequential tufts, and the tufts 111 in one row lean so that their ends remote from the face are closer to the tip end 32, and tufts 112 in a widthways adjacent row lean in the opposite way, so that their ends remote from the face are further from the tip end 32. As seen looking across the longitudinal direction the widthways adjacent rows 111, 112 appear to cross in an "X" shape. In Fig. 11 the ends of the bristles 36 remote from the bristle face also occupy a longitudinally undulating profile similar to that shown in Fig. 10 in which the ends of the bristles 36 occupy a first greater height h21 with bristle ends 113 at 11mm from the bristle face, and a second lower height h22 with ends 114 at 10mm from the bristle face.

Referring to Fig. 12 the overall arrangement of a toothbrush 120 overall of the invention is shown. The toothbrush 120 has a head 121, e.g. as shown in any of Figs. 1-11. The toothbrush 120 has a handle 122 with a neck 123 longitudinally in between.

The head 121 may be integrally connected with neck 123 or may be replaceable connectable to the handle 122.

An interproximal axis entry test was performed using a toothbrush with a head as shown in Fig. 11, and with a toothbrush with the same shaped head with the same shaped more and less displaced parts, but with all its bristles of circular cross-section. In the test pressure-sensitive paper was draped over teeth and the bristles were pressed against the teeth covered with pressure sensitive paper. Marks caused by the pressure of the bristle ends on the paper showed the depth of penetration of the bristles into the interdental spaces between the teeth, It was found that the triangular sectioned bristles of the toothbrush head of Fig. 11 penetrated deeper between the teeth than the circular-sectioned bristles of the comparison.

Claims.

1. A toothbrush head, connected to or connectable to a toothbrush handle, and which is elongated along a head longitudinal direction and has a bristle face from which bristles extend in a bristle direction, the bristle face having an undulating surface that varies, with longitudinal distance along the head, in its displacement distance in a direction perpendicular to a plane passing through the head parallel to its longitudinal direction, so that there is at least one more displaced part and at least one less displaced part, and

characterised in that bristles having a triangular cross section extend from a more displaced part of the bristle face.

2. A toothbrush head according to claim 1 characterised in that the bristle face has a longitudinally undulating profile of two or more alternating more displaced parts, with a less displaced part arranged longitudinally between each longitudinally adjacent pair of more displaced parts.

3. A toothbrush head according to claim 2 characterised by an arrangement of more and less displaced parts which comprises: a first less displaced part adjacent the end of the head furthest from the handle, a first more displaced part longitudinally adjacent to this first less displaced part and closer to the handle, a second less displaced part longitudinally adjacent the first more displaced part and closer to the handle, a second more displaced part longitudinally adjacent to this second less displaced part and closer to the handle so that the second less displaced part is longitudinally between the first and second more displaced parts, and a third less displaced part longitudinally adjacent the second more displaced part and closest to the handle.

4. A toothbrush head according to any one of the preceding claims characterised by a more displaced part in the form of a ridge which in plan looking down on the bristle face perpendicular to the longitudinal direction is a curved shape with its cusps

on opposite sides of the longitudinal axis of the head, with its convex bulge facing away from the handle.

5. A toothbrush head according to any one of the preceding claims characterised by a more displaced part in the form of a ridge which in plan looking down on the bristle face perpendicular to the longitudinal direction is a "V" or chevron shape with its apex pointing away from the handle.

6. A toothbrush head according to any one of the preceding claims characterised in that the longitudinal spacing of the most displaced parts of such at least two more displaced parts corresponds approximately to the spacing between the interproximal spaces of adjacent teeth.

7. A toothbrush head according to any one of the preceding claims characterised in that the variation in displacement distance between more and less displaced parts is 1-3 mm.

8. A toothbrush head according to any one of the preceding claims characterised in that triangular sectioned bristles extend only from the more displaced parts.

9. A toothbrush head according to any one of the preceding claims characterised in that bristles having a round cross section extend from a less displaced part of the bristle face.

10. A toothbrush head according to any one of the preceding claims characterised in that the ends of the bristles remote from the bristle face occupy a longitudinally undulating profile.

11. A toothbrush head according to claim 10 characterised in that the ends of the bristles occupy two height levels from the face, being a first greater height and a second lower height, with groups of tufts having their ends longitudinally alternatingly at the first or second height.

12. A toothbrush head according to claim 11 characterised in that tufts of the first height extend from the more displaced parts, and tufts of the second height extend from less displaced parts.

13. A toothbrush according to claim 11 or 12 characterised in that tuft or group of tufts furthest from the handle has the first, greater height.

14. A toothbrush according to claim 11, 12 or 13 characterised in that the bristles have a length 10-12 mm between the bristle face and the ends of the bristles, and the difference between the first and second height is ca. 1.0 – 1.5mm.

15. A toothbrush head according to any one of the preceding claims characterised in that bristles are at a non-perpendicular angle to the bristle face.

16. A toothbrush head according to claim 15 characterised in that bristles are in longitudinally aligned rows of longitudinally sequential tufts, and the tufts in one such row lean so that their ends remote from the face are closer to the tip end, and tufts in a widthways adjacent row may lean in the opposite way, so that as seen looking across the longitudinal direction the widthways adjacent rows appear to cross in an "X" shape.

17. A toothbrush having a toothbrush head as claimed in any one of the preceding claims, and a grip handle, with a neck between the head and handle.

Fig.2.

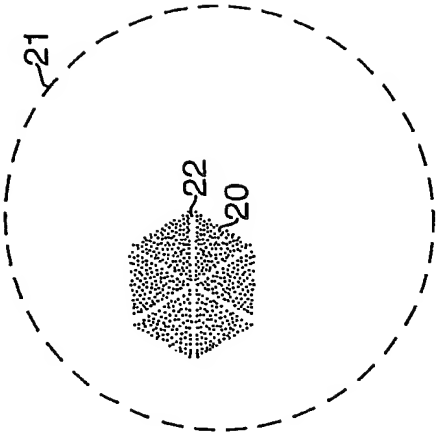


Fig.1.

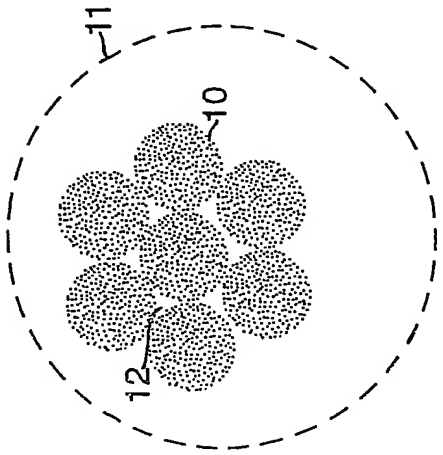
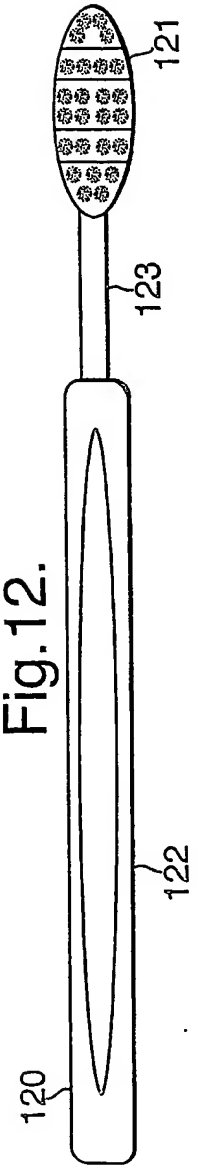


Fig.12.



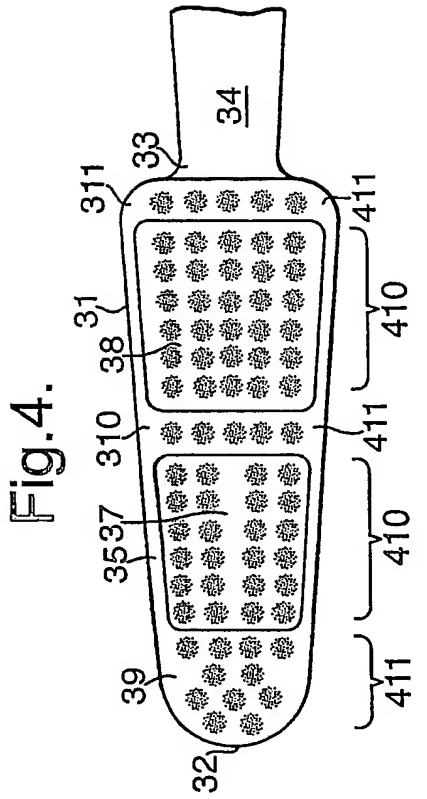


Fig.4.

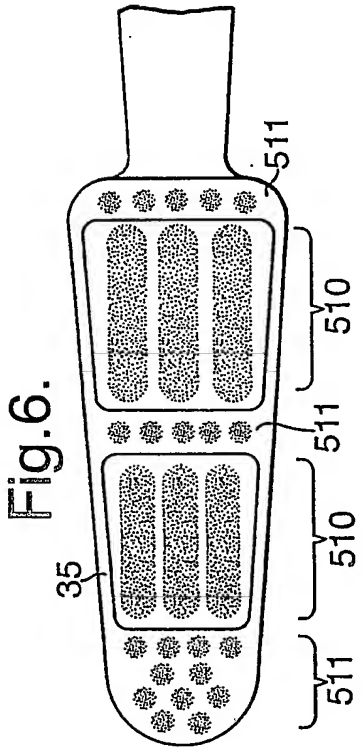


Fig.6.

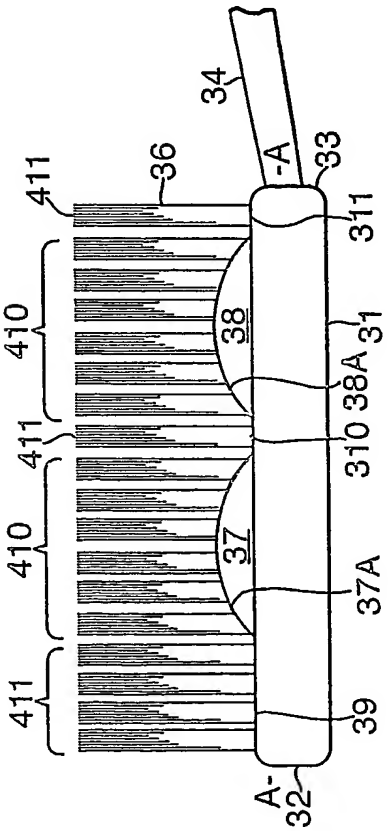


Fig.3.

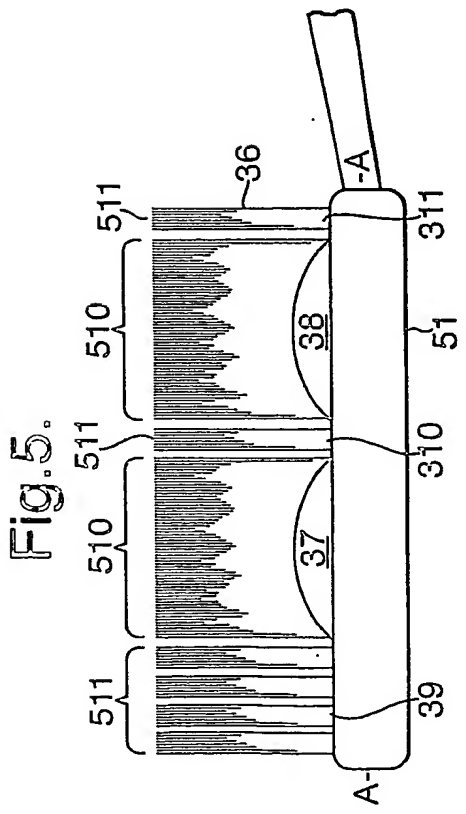


Fig.5.

Fig.7.

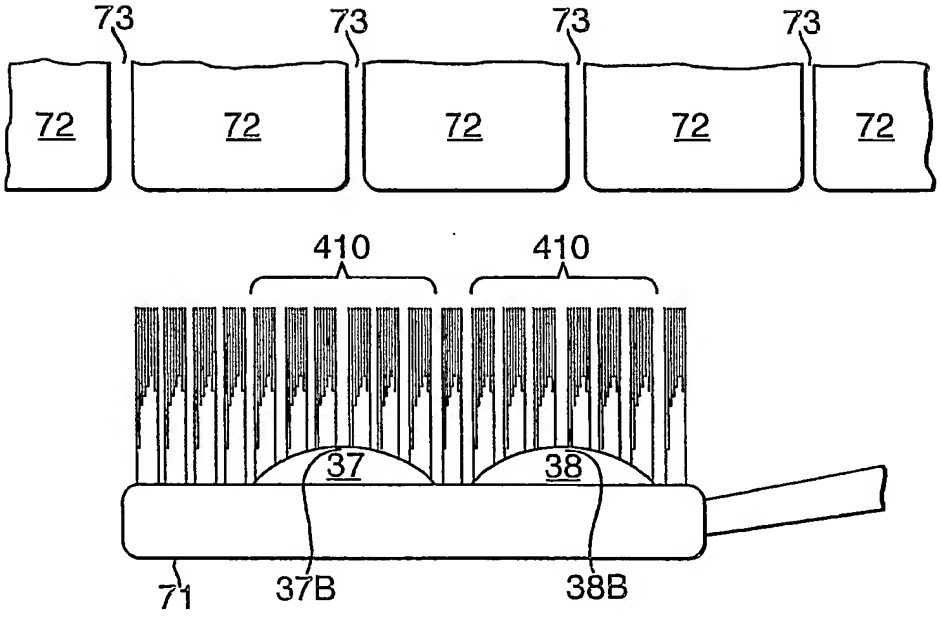
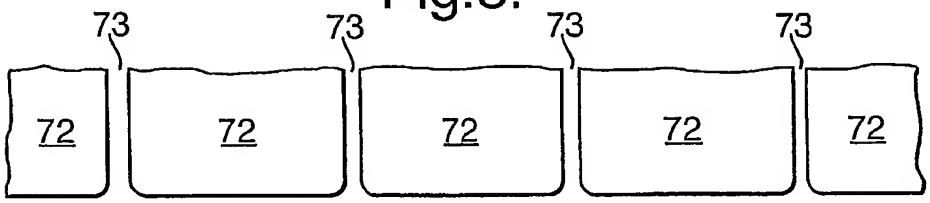


Fig.8.


73
73
73
73
72
72
72
72
72

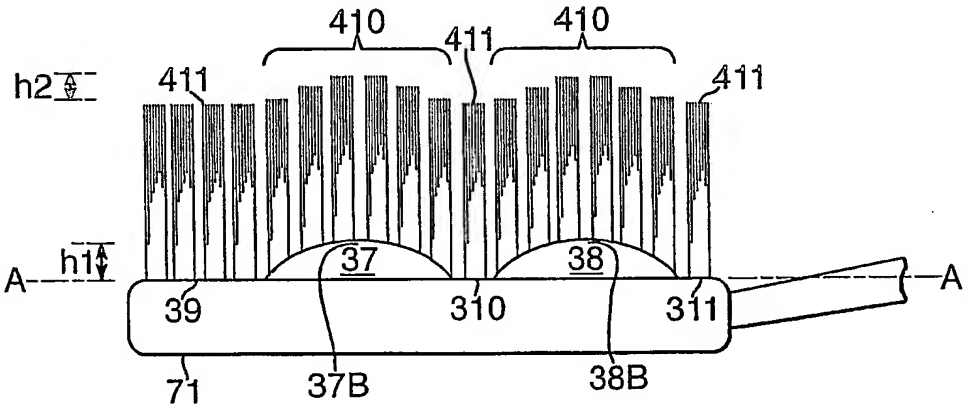

410
411
410
h2
411
411
A
h1
37
38
A
39
310
311
71
37B
38B

Fig.11.

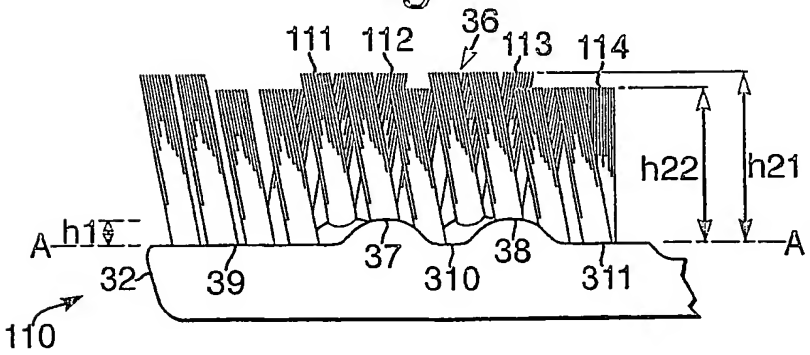

111
112
36
113
114
h22
h21
A
h1
A
32
39
37
310
38
311
110

Fig.9.

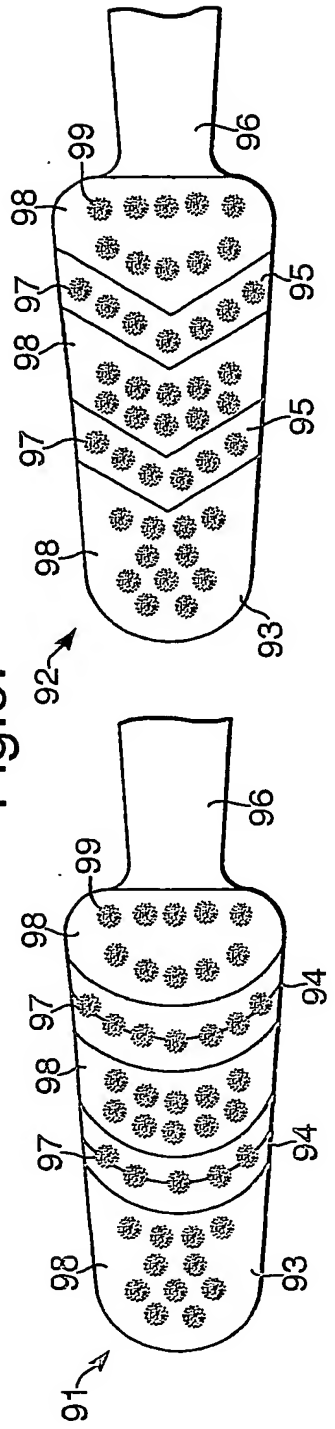
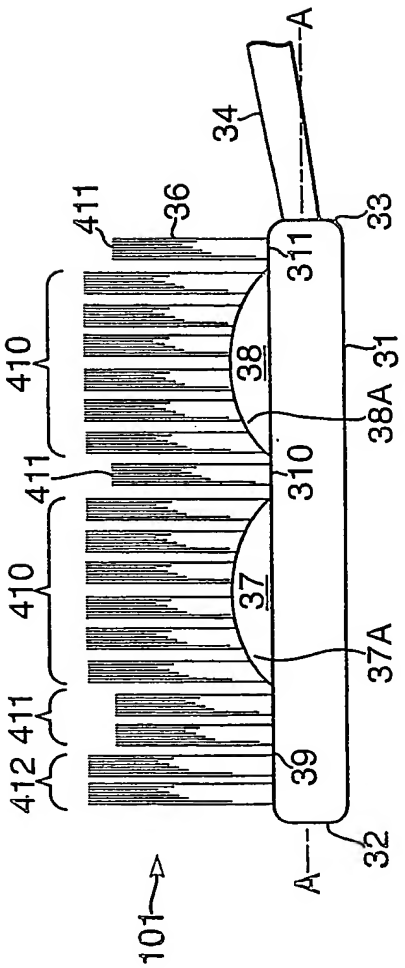

99
96
98
97
95
98
97
95
98
93
92
96
99
98
97
94
98
97
94
98
93
91

Fig.10.


A
34
411
36
33
311
410
38
31
38A
411
310
410
37
37A
412 411
39
32
A
101

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/000665

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A46B9/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A46B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 926 898 A (KRAMER HANS) 27 July 1999 (1999-07-27) column 5, line 49 -column 6, line 55; figure 4	1-17
A	GB 1 082 649 A (PHILIPS NV) 6 September 1967 (1967-09-06) the whole document	1-17
A	US 3 691 585 A (FLOM CHARLES) 19 September 1972 (1972-09-19) the whole document	1-17
A	US 4 493 125 A (COLLIS GEORGE C) 15 January 1985 (1985-01-15) column 4	1-17

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 May 2004	28/05/2004

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Cardan, C

Form PCT/ISA/210 (second sheet) (January 2004)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP2004/000665

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 926 900 A (BENNETT ROBERT ALFREAD) 27 July 1999 (1999-07-27) the whole document	1-17

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP2004/000665

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5926898 A	27-07-1999	AT 197229 T	15-11-2000
		AU 700294 B2	24-12-1998
		AU 4718296 A	11-09-1996
		BR 9607439 A	26-05-1998
		DE 69610825 D1	07-12-2000
		DE 69610825 T2	01-03-2001
		DK 812142 T3	05-02-2001
		EP 0812142 A1	17-12-1997
		FI 973482 A	25-08-1997
		GR 3035167 T3	30-04-2001
		HK 1006218 A1	31-08-2001
		JP 11501535 T	09-02-1999
		NZ 301693 A	26-05-2000
		SI 812142 T1	30-06-2001
		CA 2212522 A1	29-08-1996
		WO 9625866 A1	29-08-1996
		ES 2152511 T3	01-02-2001
		PT 812142 T	30-03-2001
		ZA 9601456 A	04-09-1996
GB 1082649 A	06-09-1967	NONE	
US 3691585 A	19-09-1972	NONE	
US 4493125 A	15-01-1985	US 4382309 A	10-05-1983
		CA 1220310 A1	14-04-1987
		EP 0118852 A2	19-09-1984
		ZA 8303811 A	30-01-1985
		AR 226374 A1	30-06-1982
		AU 536993 B2	31-05-1984
		AU 7367581 A	11-02-1982
		BR 8105013 A	20-04-1982
		CA 1165064 A1	10-04-1984
		DE 3131014 A1	22-04-1982
		FR 2488112 A1	12-02-1982
		GB 2083346 A ,B	24-03-1982
		HK 71285 A	27-09-1985
		IN 155342 A1	19-01-1985
		IT 1168157 B	20-05-1987
		JP 57052408 A	27-03-1982
		JP 60103328 U	15-07-1985
		MX 152778 A	22-05-1986
		NZ 197945 A	30-03-1984
		SG 36294 G	13-01-1995
		ZA 8105361 A	28-07-1982
US 5926900 A	27-07-1999	AU 749696 B2	04-07-2002
		AU 8539498 A	04-01-1999
		BR 9810033 A	19-09-2000
		CA 2293268 A1	23-12-1998
		CN 1259024 T	05-07-2000
		WO 9857570 A1	23-12-1998
		HU 0003030 A2	29-01-2001
		ID 23907 A	25-05-2000
		JP 2002504001 T	05-02-2002
		PL 337363 A1	14-08-2000
		TR 9903107 T2	22-05-2000
		AU 8338698 A	04-01-1999

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP2004/000665

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5926900 A		BR 9810036 A	19-09-2000
		CA 2293799 A1	23-12-1998
		CN 1267197 T	20-09-2000
		WO 9857569 A1	23-12-1998
		ID 23414 A	20-04-2000
		JP 2002508686 T	19-03-2002
		PL 337430 A1	14-08-2000
		TR 9903106 T2	21-04-2000
		US 5908038 A	01-06-1999
		ZA 9805186 A	17-12-1999
		ZA 9805190 A	17-12-1999